

FORM PTO-1390 (REV. 9-2001)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY'S DOCKET NUMBER 60,130-1308
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371			U.S. APPLICATION NO. (If known, see 37 CFR 1.5) 10/030024
INTERNATIONAL APPLICATION NO. WO-01/02677-A2 GB00/02540	INTERNATIONAL FILING DATE 30 June 2000	PRIORITY DATE CLAIMED 1 July 1999	
TITLE OF INVENTION Latch Assembly			
APPLICANT(S) FOR DO/EO/US Evans, et al.			
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:			
<p>1. <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.</p> <p>2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.</p> <p>3. <input checked="" type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.</p> <p>4. <input checked="" type="checkbox"/> The US has been elected by the expiration of 19 months from the priority date (Article 31).</p> <p>5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2))</p> <p>a. <input checked="" type="checkbox"/> is attached hereto (required only if not communicated by the International Bureau).</p> <p>b. <input type="checkbox"/> has been communicated by the International Bureau.</p> <p>c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US).</p> <p>6. <input type="checkbox"/> An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).</p> <p>a. <input type="checkbox"/> is attached hereto.</p> <p>b. <input type="checkbox"/> has been previously submitted under 35 U.S.C. 154(d)(4).</p> <p>7. <input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))</p> <p>a. <input type="checkbox"/> are attached hereto (required only if not communicated by the International Bureau).</p> <p>b. <input type="checkbox"/> have been communicated by the International Bureau.</p> <p>c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired.</p> <p>d. <input type="checkbox"/> have not been made and will not be made.</p> <p>8. <input type="checkbox"/> An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).</p> <p>9. <input type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).</p> <p>10. <input type="checkbox"/> An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).</p> <p>Items 11 to 20 below concern document(s) or information included:</p> <p>11. <input type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98.</p> <p>12. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.</p> <p>13. <input checked="" type="checkbox"/> A FIRST preliminary amendment.</p> <p>14. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment.</p> <p>15. <input type="checkbox"/> A substitute specification.</p> <p>16. <input type="checkbox"/> A change of power of attorney and/or address letter.</p> <p>17. <input type="checkbox"/> A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.</p> <p>18. <input type="checkbox"/> A second copy of the published international application under 35 U.S.C. 154(d)(4).</p> <p>19. <input type="checkbox"/> A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).</p> <p>20. <input type="checkbox"/> Other items or information:</p>			

U.S. APPLICATION NO. (if known) 10/030024		INTERNATIONAL APPLICATION NO. WO 01/02677 A2		ATTORNEY'S DOCKET NUMBER 60.130-1308	
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21. <input checked="" type="checkbox"/> The following fees are submitted: BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)): Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO. \$1040.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$890.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$740.00 International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$710.00 International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) \$100.00 ENTER APPROPRIATE BASIC FEE AMOUNT =				CALCULATIONS PTO USE ONLY	
				\$ 1040.00	
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				\$	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	\$	
Total claims	28 - 20 =	8	x \$18.00	\$ 144.00	
Independent claims	3 - 3 =		x \$84.00	\$	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)				+ \$280.00	
TOTAL OF ABOVE CALCULATIONS =				\$ 1184.00	
<input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.				\$	
SUBTOTAL =				\$ 1184.00	
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				\$	
TOTAL NATIONAL FEE =				\$ 1184.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +				\$	
TOTAL FEES ENCLOSED =				\$ 1184.00	
				Amount to be refunded:	\$
				charged:	\$

a. ☒ A check in the amount of \$ **1184.00** to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. **50-1482** in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

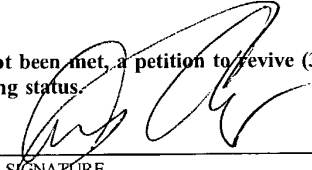
c. ☐ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **50-1482**. A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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SIGNATURE
Anthony P. Cho
NAME
47,209
REGISTRATION NUMBER

10030024-101102

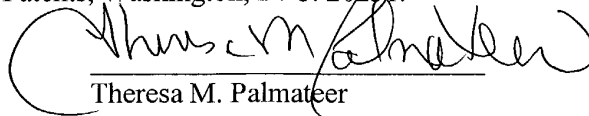
10/030024

531 Rec'd PCT/PT 02 JAN 2002

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"EXPRESS MAIL" Mailing Label No. EL 860081428 US Date of Deposit December 31, 2001.

I hereby certify that this paper is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to Box PCT, Assistant Commissioner of Patents, Washington, D. C. 20231.


Theresa M. Palmateer

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EL860081428US

100300024-1102
10/030024
Docket No. 60,130-1308

531 Rec'd PCT/PTC 02 JAN 2002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application: Evans, et al.
Serial No.: Herewith
Filed: Herewith
Priority: PCT/GB00/02540 Filed: June 30, 2000
GB 9915432.0 Filed: July 1, 1999
Group Art Unit: Unknown
Examiner: Unknown
For: LATCH ASSEMBLY

PRELIMINARY AMENDMENT

Box PCT
Assistant Commissioner of Patents
Washington, D.C. 20231

Dear Sir:

Please amend the application in the following particulars prior to examination.

IN THE SPECIFICATIONS

Page 1, after the title and before the first paragraph, please insert the following paragraph and section heading:

-- This patent application claims priority to Great Britain Patent Application No. GB 9915432.0 filed on July 1, 1999 and PCT Application PCT/GB00/02540, filed on June 30, 2000.

BACKGROUND OF THE INVENTION --

Page 1, please replace the second full paragraph with:

The present invention is particularly applicable to latches used on vehicle doors such as car passenger doors or car trunk doors.

Page 1, please replace the third full paragraph with:

Vehicle door latches are known which are released using a power actuator. Typically the door latch would have a latch bolt retained in position by a pawl and the actuator would act on a release lever connected to the pawl or would act directly on the pawl to release the latch. After the actuator's power stroke, the actuator must return to its initial state in one of three traditional methods:

Page 1, please replace the fourth full paragraph with:

a) Reverse energizing of the motor such that the motor is spun in its opposite direction e.g., reversing the polarity on an electric motor,

Page 2, please replace the third full paragraph with:

However a problem with such an arrangement is that under some conditions the seal force which tends to open the door can be insufficient to push the latch bolt past the secondary latched position resulting in a door that only opens to the secondary latched position. Under such circumstances the latch has to be unlatched again from the secondary latched position either manually by pulling on a door handle again or in the case of an actuator driven latch by operating the actuator for a second time and pulling the door open. Insufficient seal load could be caused by a door frozen into a closed position, poor fit/misalignment of the door, heavy vertically opening rear trunk lids.

Page 2, after the fifth full paragraph, please insert the following section heading:

--SUMMARY OF THE INVENTION--

Page 3, please replace the third full paragraph with:

According to a further aspect of the present invention there is provided latch mechanism including a power actuator, the power actuator having a motor and a drive train, the drive train having at least one abutment for engagement with a release means of the latch mechanism, energization of the motor causing the abutment to move the release means from a first engaged position to a second released position to release the latch, in which a retention means (58) is capable of retaining the release means in its second released position.

Page 3, please replace the fourth full paragraph with:

According to a further aspect of the present invention there is provided a latch mechanism including a power actuator, the power actuator having a motor and a drive train, the drive train having the plurality of abutments for engagement with a release arrangement of the latch mechanism, energization of the motor causing one of the plurality of abutments to move the release arrangement from a first engaged position to second released position to release the latch, resulting in another of the plurality of abutments co-operating with the release arrangement to provide a drive train stop.

Page 4, before the first full paragraph, please insert the following section heading:

--BRIEF DESCRIPTION OF THE DRAWINGS--

Page 4, please replace the first full paragraph with:

The invention will now be described, by way of example only, with reference to the drawings in which:

Page 4, after the sixth full paragraph, please insert the following section heading:

--DESCRIPTION OF PREFERRED EMBODIMENT--

Page 7, please replace the first full paragraph with:

The motor is energized for say 800 milliseconds, causing the rotor 24 to rotate anticlockwise in the direction of arrow A of the figure 2 resulting in post 30A engaging and moving first arm 52 to the position shown in figure 2. Clearly this movement of first arm 52 causing the release lever 50 and the first pawl 44 to both rotate about pivot 46 in a clockwise direction as shown by arrows B and C, thus disengaging pawl 48 from primary latching abutment 36.

Page 7, please replace the third full paragraph with:

Typically the time taken to move from the position as shown in figure 1 to the position as shown figure 2 might be 500 milliseconds, thus the motor would be stalled for the last 300 milliseconds of the 800 millisecond motor energization as a result of post 30C abutting the end of second arm 54.

Page 7, please replace the fourth full paragraph with:

Once the latch assembly has achieved the position as shown in figure 2 the latch claw is free to rotate in a clockwise direction as shown by arrow E of figure 3 thus releasing the striker from the mouth 27 and allowing the door, or trunk lid, etc. to open.

Page 9, please replace the second full paragraph with:

Subsequent energizing of the motor 18 following closing of the latch as shown in figure 4 will unlatch the door in a similar sequence as described above, but note that post 30C (as opposed to post 30A as described above) is now positioned to act on first arm 52 to open the latch. In this case since there are three posts 30A, 30B and 30C, a single energizing operation of motor 18 results in rotor 24 only rotating through 120 degrees.

Page 10, please replace the fourth full paragraph with:

Operation of the latch assembly 110 is as follows:

IN THE CLAIMS:

Page 1, before the first claim, please insert the section heading:

--What is claimed is:--

Please replace claim 1 as follows:

1. (Amended) A latch mechanism including;
 - a latch bolt moveable between a primary latched position and an open position,
 - a first pawl moveable between a first engaged position, where the first pawl secures the latch bolt in at least its primary latched position and a second released position, where the first pawl releases the latch bolt from at least its first primary latched position,
 - release means moveable between a first engaged position, where the release means allows the first pawl to achieve its first engaged position and a second released position, where the release means retains the first pawl in its second released position, and
 - a second pawl moveable between a first engaged position, where the second pawl is capable of retaining the release means in its second released position, and a second released position, where the second pawl releases the release means from its second released position,
 - such that the latch mechanism can be latched and unlatched.

Please replace claim 4 as follows:

4. (Amended) A latch mechanism as defined in claim 1 in which the latch bolt additionally has a secondary latched position intermediate the primary latch position and the open position.

Please replace claim 5 as follows:

5. (Amended) A latch mechanism as defined in claim 1 in which a trip abutment on the latch bolt is capable of moving the second pawl from its first engaged position to its second released position allowing the latch mechanism to latch.

Please replace claim 7 as follows:

7. (Amended) A latch mechanism as defined in claim 5 in which the trip abutment does not affect retention of the release means in its second released position by the second pawl during movement of the latch bolt from its primary or secondary latched position to its open position.

Please replace claim 8 as follows:

8. (Amended) A latch mechanism as defined in claim 5 in which the trip abutment moves the second pawl by engagement with a third pawl.

Please replace claim 10 as follows:

10. (Amended) A latch mechanism as defined in claim 8 in which the third pawl is mounted on the second pawl.

Please replace claim 11 as follows:

11. (Amended) A latch mechanism as defined in claim 8 in which the third pawl is mounted on a chassis of the latch assembly.

Please replace claim 12 as follows:

12. (Amended) A latch mechanism as defined in claim 1 in which a first arm of the release means is engaged to move the release means from its first engaged position to its second released position.

Please replace claim 13 as follows:

13. (Amended) A latch mechanism as defined in claim 1 in which an arm (56) of the release means is engaged by the second pawl to retain the release means in its second released position.

Please replace claim 14 as follows:

14. (Amended) A latch mechanism as defined in claim 1 including a power actuator having a motor and a drive train.

Please replace claim 16 as follows:

16. (Amended) A latch mechanism as defined in claim 14 in which the drive train only operates in one direction.

Please replace claim 17 as follows:

17. (Amended) A latch mechanism as defined in claim 14 in which the drive train includes a first abutment operable to move the release means from its first engaged position to its second released position.

Please replace claim 18 as follows:

18. (Amended) A latch mechanism as defined in claim 17 in which the first abutment of the drive train engages the first arm of the release means.

Please replace claim 19 as follows:

19. (Amended) A latch mechanism as defined in claim 14 in which the drive train includes a second abutment which co-operates with the release means to provide a drive train stop.

Please replace claim 21 as follows:

21. (Amended) A latch mechanism as defined in claim 19 when dependent upon claim 17 in which the first abutment is capable of acting as the second abutment.

Please replace claim 22 as follows:

22. (Amended) A latch mechanism including a power actuator, the power actuator having a motor and a drive train, the drive train having at least one abutment for engagement with a release means of the latch mechanism, energization of the motor causing the abutment to move the release means from a first engaged position to a second released position to release the latch, in which a retention means (58) is capable of retaining the release means in its second released position.

Please replace claim 23 as follows:

23. (Amended) A latch mechanism including a power actuator, the power actuator having a motor and a drive train, the drive train having a plurality of abutments for engagement with a release arrangement of the latch mechanism, energization of the motor causing one of the plurality of abutments to move the release arrangement from a first engaged position to second released position to release the latch, resulting in another of the plurality of abutments co-operating with the release arrangement to provide a drive train stop.

Please replace claim 24 as follows:

24. (Amended) A latch mechanism as defined in Claim 23 in which the latch mechanism includes a latch bolt moveable between a primary latch position and an open position, and the release arrangement includes a first pawl moveable between a first engaged position where the first pawl secures the latch bolt in at least its primary latch position and a second release position, where the first pawl releases the latch bolt from at least its first primary latch position, the release arrangement further including release means moveable between the first engaged position, where the release means allows the first pawl to achieve its first engaged position and a second release position where the release means retains the first pawl in its second release position.

Please replace claim 27 as follows:

27. (Amended) A latch mechanism as defined in Claim 23 in which the plurality of abutments includes a first set of abutments to move the release arrangement from the first engaged position to the second release position and a second set of abutments for co-operation with the release arrangement to provide the drive train stop.

Please replace claim 28 as follows:

28. (Amended) A latch mechanism as defined in Claim 27 in which the first set of abutments acts on the release means and the second set of abutments act on the pawl.

IN THE ABSTRACT:

Please replace the abstract with:

A latch mechanism (10) including a latch bolt (32) moveable between a primary latched position and an open position, a first pawl (44) moveable between a first engaged position, where it secures the latch bolt in at least its primary latched position and a second released position, where it releases the latch bolt from at least its first primary latched position, release means (50) moveable between a first engaged position, where it allows the first pawl to achieve its first engaged position and a second released position, where it retains the first pawl in its second released position, and a second pawl (58) moveable between a first engaged position, where it is capable of retaining the release means in its second released position, and a second released position, where it releases the release means from its second released position, such that the latch mechanism can be latched and unlatched (figure 1).

REMARKS

Applicant respectfully requests examination of this application.

Respectfully submitted,

CARLSON, GASKEY & OLDS

By: 

Anthony P. Cho
Registration No. 47,209
400 W. Maple Rd., Ste. 350
Birmingham, MI 48009
(248) 988-8360

Dated: December 31, 2001

APPENDIX 1

**“VERSION WITH MARKINGS TO SHOW CHANGES MADE
TO THE SPECIFICATIONS”**

Page 1, please replace the second full paragraph with:

The present invention is particularly applicable to latches used on vehicle doors such as car passenger doors or car [boot] trunk doors.

Page 1, please replace the third full paragraph with:

Vehicle door latches are known which are released using a power actuator. Typically the door latch would have a latch bolt retained in position by a pawl and the actuator would act on a release lever connected to the pawl or would act directly on the pawl to release the latch. After the actuator's power stroke, the actuator must return to its initial state in one of three traditional methods: [-]

Page 1, please replace the fourth full paragraph with:

a) Reverse [energising] energizing of the motor such that the motor is spun in its opposite direction e.g.. reversing the polarity on an electric motor,

Page 2, please replace the third full paragraph with:

However a problem with such an arrangement is that under some conditions the seal force which tends to open the door can be insufficient to push the latch bolt past the secondary latched position resulting in a door that only opens to the secondary latched position. Under such circumstances the latch has to be unlatched again from the secondary latched position either manually by pulling on a door handle again or in the case of an actuator driven latch by operating the actuator for a second time and pulling the door open. Insufficient seal load could be caused by a door frozen into a closed position, poor fit/misalignment of the door, heavy vertically opening rear [boot] trunk lids.

Page 3, please replace the third full paragraph with:

According to a further aspect of the present invention there is provided latch mechanism including a power actuator, the power actuator having a motor and a drive train, the drive train having at least one abutment for engagement with a release means of the latch mechanism, [energisation] energization of the motor causing the abutment to move the release means from a first engaged position to a second released position to release the latch, in which a retention means (58) is capable of retaining the release means in its second released position.

Page 3, please replace the fourth full paragraph with:

According to a further aspect of the present invention there is provided a latch mechanism including a power actuator, the power actuator having a motor and a drive train, the drive train having the plurality of abutments for engagement with a release arrangement of the latch mechanism, [energisation] energization of the motor causing one of the plurality of abutments to move the release arrangement from a first engaged position to second released position to release the latch, resulting in another of the plurality of abutments co-operating with the release arrangement to provide a drive train stop.

Page 4, please replace the first full paragraph with:

The invention will now be described, by way of example only, with reference to the drawings in which: [-]

Page 7, please replace the first full paragraph with:

The motor is [energised] energized for say 800 milliseconds, causing the rotor 24 to rotate anticlockwise in the direction of arrow A of the figure 2 resulting in post 30A engaging and moving first arm 52 to the position shown in figure 2. Clearly this movement of first arm 52 causing the release lever 50 and the first pawl 44 to both rotate about pivot 46 in a clockwise direction as shown by arrows B and C, thus disengaging pawl 48 from primary latching abutment 36.

Page 7, please replace the third full paragraph with:

Typically the time taken to move from the position as shown in figure 1 to the position as shown figure 2 might be 500 milliseconds, thus the motor would be stalled for the last 300 milliseconds of the 800 millisecond motor [energisation] energization as a result of post 30C abutting the end of second arm 54.

Page 7, please replace the fourth full paragraph with:

Once the latch assembly has achieved the position as shown in figure 2 the latch claw is free to rotate in a clockwise direction as shown by arrow E of figure 3 thus releasing the striker from the mouth 27 and allowing the door, or [boot] trunk lid, etc. to open.

Page 9, please replace the second full paragraph with:

Subsequent [energising] energizing of the motor 18 following closing of the latch as shown in figure 4 will unlatch the door in a similar sequence as described above, but note that post 30C (as opposed to post 30A as described above) is now positioned to act on first arm 52 to open the latch. In this case since there are three posts 30A, 30B and 30C, a single [energising] energizing operation of motor 18 results in rotor 24 only rotating through 120 degrees.

Page 10, please replace the fourth full paragraph with:

Operation of the latch assembly 110 is as follows: [-]

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531 Rec'd PCT/77 02 JAN 2002

APPENDIX 2

**“VERSION WITH MARKINGS TO SHOW CHANGES MADE
IN THE CLAIMS”**

Please replace claim 1 as follows:

1. (Amended) A latch mechanism including;

a latch bolt moveable between a primary latched position and an open position,

a first pawl moveable between a first engaged position, where [it] the first pawl secures the latch bolt in at least its primary latched position and a second released position, where [it] the first pawl releases the latch bolt from at least its first primary latched position,

release means moveable between a first engaged position, where [it] the release means allows the first pawl to achieve its first engaged position and a second released position, where [it] the release means retains the first pawl in its second released position, and

a second pawl moveable between a first engaged position, where [it] the second pawl is capable of retaining the release means in its second released position, and a second released position, where [it] the second pawl releases the release means from its second released position,

such that the latch mechanism can be latched and unlatched.

Please replace claim 4 as follows:

4. (Amended) A latch mechanism as defined in [any preceding] claim 1 in which the latch bolt additionally has a secondary latched position intermediate the primary latch position and the open position.

Please replace claim 5 as follows:

5. (Amended) A latch mechanism as defined in [any preceding] claim 1 in which a trip abutment on the latch bolt is capable of moving the second pawl from its first engaged position to its second released position allowing the latch mechanism to latch.

Please replace claim 7 as follows:

7. (Amended) A latch mechanism as defined in claim 5 [or 6] in which the trip abutment does not affect retention of the release means in its second released position by the second pawl during movement of the latch bolt from its primary or secondary latched position to its open position.

Please replace claim 8 as follows:

8. (Amended) A latch mechanism as defined in claim 5 [or 6 or 7] in which the trip abutment moves the second pawl by engagement with a third pawl.

Please replace claim 10 as follows:

10. (Amended) A latch mechanism as defined in claim 8 [or 9] in which the third pawl is mounted on the second pawl.

Please replace claim 11 as follows:

11. (Amended) A latch mechanism as defined in claim 8 [or 9] in which the third pawl is mounted on a chassis of the latch assembly.

Please replace claim 12 as follows:

12. (Amended) A latch mechanism as defined in [any preceding] claim 1 in which a first arm of the release means is engaged to move the release means from its first engaged position to its second released position.

Please replace claim 13 as follows:

13. (Amended) A latch mechanism as defined in [any preceding] claim 1 in which an arm (56) of the release means is engaged by the second pawl to retain the release means in its second released position.

Please replace claim 14 as follows:

14. (Amended) A latch mechanism as defined in [any preceding] claim 1 including a power actuator having a motor and a drive train.

Please replace claim 16 as follows:

16. (Amended) A latch mechanism as defined in claim 14 [or 15] in which the drive train only operates in one direction.

Please replace claim 17 as follows:

17. (Amended) A latch mechanism as defined in [any one of] claim[s] 14 [to 16] in which the drive train includes a first abutment operable to move the release means from its first engaged position to its second released position.

Please replace claim 18 as follows:

18. (Amended) A latch mechanism as defined in claim 17 [when dependent upon claim 12] in which the first abutment of the drive train engages the first arm of the release means.

Please replace claim 19 as follows:

19. (Amended) A latch mechanism as defined in claim[s] 14 [to 18] in which the drive train includes a second abutment which co-operates with the release means to provide a drive train stop.

Please replace claim 21 as follows:

21. (Amended) A latch mechanism as defined in claim 19 [or 20] when dependent upon claim 17 in which the first abutment is capable of acting as the second abutment.

Please replace claim 22 as follows:

22. (Amended) A latch mechanism including a power actuator, the power actuator having a motor and a drive train, the drive train having at least one abutment for engagement with a release means of the latch mechanism, [energisation] energization of the motor causing the abutment to move the release means from a first engaged position to a second released position to release the latch, in which a retention means (58) is capable of retaining the release means in its second released position.

Please replace claim 23 as follows:

23. (Amended) A latch mechanism including a power actuator, the power actuator having a motor and a drive train, the drive train having a plurality of abutments for engagement with a release arrangement of the latch mechanism, [energisation] energization of the motor causing one of the plurality of abutments to move the release arrangement from a first engaged position to second released position to release the latch, resulting in another of the plurality of abutments co-operating with the release arrangement to provide a drive train stop.

Please replace claim 24 as follows:

24. (Amended) A latch mechanism as defined in Claim 23 in which the latch mechanism includes a latch bolt moveable between a primary latch position and an open position, and the release arrangement includes a first pawl moveable between a first engaged position where [it] the first pawl secures the latch bolt in at least its primary latch position and a second release position, where [is] the first pawl releases the latch bolt from at least its first primary latch position, the release arrangement further including release means moveable between the first engaged position, where [it] the release means allows the first pawl to achieves its first engaged position and a second release position where [it] the release means retains the first pawl in its second release position.

Please replace claim 27 as follows:

27. (Amended) A latch mechanism as defined in Claim[s] 23 [to 26] in which the plurality of abutments includes a first set of abutments to move the release arrangement from the first engaged position to the second release position and a second set of abutments for co-operation with the release arrangement to provide the drive train stop.

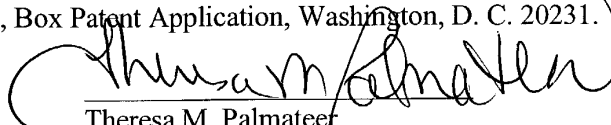
Please replace claim 28 as follows:

28. (Amended) A latch mechanism as defined in Claim 27 [when dependent upon Claim 24] in which the first set of abutments acts on the release means and the second set of abutments act on the pawl.

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Theresa M. Palmateer

The present invention relates to latch assemblies, and in particular latch assemblies which are manually operable alone or latch assemblies which are both manually operable and power actuator operable.

The present invention is particularly applicable to latches used on vehicle doors such as car passenger doors or car boot doors.

Vehicle door latches are known which are released using a power actuator. Typically the door latch would have a latch bolt retained in position by a pawl and the actuator would act on a release lever connected to the pawl or would act directly on the pawl to release the latch. After the actuator's power stroke, the actuator must return to its initial state in one of three traditional methods:-

- a) Reverse energising of the motor such that the motor is spun in its opposite direction e.g., reversing the polarity on an electric motor,
- b) Declutching a clutch mechanism situated between the motor and a drive train of the actuating mechanism and returning the drive train by a weak spring,
- c) Back driving the whole of the actuator mechanism including motor and drive train a strong spring.

The problem with reversing the polarity is that many modern vehicle controllers do not allow reverse polarity and more noise is generated due to longer motor operating duration.

The problem with an actuator incorporating a clutch mechanism is that the clutch mechanism itself is expensive, complex and has several parts and that such clutches do not operate consistently.

The problem with back driving the motor and power train is that the motor must be more powerful (and thus more expensive and heavier) to overcome the strong spring, more noise is generated due to longer operating duration, and some systems using helical gears cannot be back driven due to the large lead angle of the helical gears.

Known latch assemblies have primary latched positions wherein the associated door is fully closed and secondary latched positions wherein the associated door is not fully shut but nevertheless is prevented from opening. Such an arrangement has been used particularly on passenger doors of cars as a safety feature and in a legal requirement in many countries. Typically the door seals situated around the periphery of the door, which provide a weather tight seal between the door and its associated aperture, are resilient and are compressed when the door is in its closed condition. Releasing of the latch then allows the seals to partially open the door, at least past the secondary latched position, allowing the user to then fully open the door.

However a problem with such an arrangement is that under some conditions the seal force which tends to open the door can be insufficient to push the latch bolt past the secondary latched position resulting in a door that only opens to the secondary latched position. Under such circumstances the latch has to be unlatched again from the secondary latched position either manually by pulling on a door handle again or in the case of an actuator driven latch by operating the actuator for a second time and pulling the door open. Insufficient seal load could be caused by a door frozen into a closed position, poor fit/misalignment of the door, heavy vertically opening rear boot lids.

It is an object of the present invention to provide a latch assembly including a power actuator which does not require to be driven in a reverse direction.

It is another object of the present invention to provide a latch assembly including a power actuator which does not require clutch mechanisms between a motor and a drive train of the power actuator.

It is another object of the present invention to provide a latch assembly including a power actuator which does not require back driving of the drive train and motor.

It is another object of the present invention to provide a latch assembly having a latch mechanism that does not engage a secondary latch position when operated.

Thus according to the present invention there is provided a latching mechanism including a latch bolt moveable between a primary latched position and an open position,

a first pawl moveable between a first engaged position where it secures the latch bolt in at least its primary latched position and a second released position where it releases the latch bolt from at least its first primary latched position,

release means moveable between a first engaged position where it allows the first pawl to achieve its first engaged position and a second released position where it retains the first pawl in its second released position, and

a second pawl moveable between a first engaged position where it is capable of retaining the release means in its second released position and a second released position where it releases the release means from its second released position

such that the latch mechanism can be latched and unlatched.

According to a further aspect of the present invention there is provided latch mechanism including a power actuator, the power actuator having a motor and a drive train, the drive train having at least one abutment for engagement with a release means of the latch mechanism, energisation of the motor causing the abutment to move the release means from a first engaged position to a second released position to release the latch, in which a retention means (58) is capable of retaining the release means in its second released position.

According to a further aspect of the present invention there is provided a latch mechanism including a power actuator, the power actuator having a motor and a drive train, the drive train having the plurality of abutments for engagement with a release arrangement of the latch mechanism, energisation of the motor causing one of the plurality of abutments to move the release arrangement from a first engaged position to second released position to release the latch, resulting in another of the plurality of abutments co-operating with the release arrangement to provide a drive train stop.

The invention will now be described, by way of example only, with reference to the drawings in which:-

Figure 1 is a view of a latch assembly according to the present invention in a closed condition;

Figure 2 is a view of the latch assembly of figure 1 shown in an unlatching condition;

Figure 3 is a view of the latch assembly of figure 1 shown in a latch opening condition;

Figure 4 is a view of the latch assembly of figure 1 shown in a latching condition whereby super-imposed views of the rotating claw are shown in a primary latched position and secondary latched position; and

Figures 5 and 6 are views of a second embodiment of a latch assembly according to the present invention in an open and closed condition.

With reference to figure 1 to 4 there is shown a latch assembly 10 including a power actuator 12, a latch mechanism 14 and a manual release means 16.

In use the latch assembly 10 would be mounted on a door.

The power actuator includes a motor 18 having a motor shaft 20 drivingly connected to a pinion 22. The power actuator further includes a drive train in the form of a rotor 24.

Rotor 24 is journaled for rotation on plate 26 which forms part of the chassis of the latch assembly. Rotor 24 includes a set of gear teeth 28 which together with pinion 22 form a worm/worm gear drive arrangement. The rotor further includes three circumferentially equispaced posts 30A, 30B, 30C, which project out of the plane of the paper of figure 1.

The latched mechanism includes a latch bolt in the form of a rotating claw 32 having a mouth 34, a primary latching abutment 36, a secondary latching abutment 38 and a trip abutment in the form of a pin 40. The claw 32 is pivotally mounted about pivot 42 on plate 26.

Plate 26 includes a mouth 27 which in conjunction with the mouth 34 provides for the retention and release of a striker pin (not shown) mounted on an associated door aperture.

The rotating claw 32 is biased in a clockwise direction as shown in figure 1 by a resilient means (not shown), though in further embodiments this need not be the case.

The latch mechanism further includes a first pawl 44 pivotally mounted for rotation about pivot 46. Pawl 44 includes a pawl tooth 48 for engagement with the primary and secondary latching abutments 36 and 38 of the rotating claw. Also mounted rotationally about pivot 46 is a release lever 50 having first, second and third arms 52, 54, 56 respectively. Release lever 50 is biased in an anticlockwise direction by a resilient means (not shown) operably acting between the release lever 50 and the plate 26.

A further resilient means (not shown) operates between the first pawl 44 and release lever 50 to bias the first pawl 44 in an anticlockwise direction relative to the release lever

50. Abutment 44A on the first pawl and abutment 50A release on the lever co-operate to limit the anticlockwise movement of the first pawl relative to the release lever.

The latch mechanism further includes a second pawl 58 rotatably mounted about pivot 60 which is turn is mounted on plate 26. Second pawl 58 includes a hook 62 remote from pivot 60 and also a cam surface 64. Second pawl 58 is biased in an anticlockwise direction by a resilient means (not shown) operating between the second pawl 58 and the plate 26. An abutment (not shown) prevents the second pawl 58 from rotating further anticlockwise than is shown in figure 1.

Mounted on second pawl 58 is a third pawl 66 pivotally mounted about pivot 68. Third pawl 66 is arranged such that it can pivot anticlockwise about pivot 68 as a result of contact with pin 40 when the rotating claw 32 moves from a position shown in figure 1 to a position shown in figure 3 i.e. in an opening direction but cannot rotate about pivot 68 clockwise from the position shown in figures 1 and 4 when the rotating claw 32 (and hence the pin 40) moves from the position as shown in figure 4 to the position as shown in figure 1 i.e. in a closing, there being an abutment (not shown) to prevent any such clockwise rotation.

In further embodiments the third pawl could be mounted on the chassis of the latch assembly and nevertheless co-operate with the second claw 58 and pin 40 to release the latch mechanism as described below.

The manual release means 16 comprises a boss 70 having three equispaced lobes 72A, 72B and 72C which bear on an inner surface of the rotor 24 to allow rotation of the boss 70 relative to the plate 26. Lobe 72A includes a post 74 projecting out of the plane of the paper of figure 1 substantially parallel to post 30A.

Lobe 72B further includes an arm 76 having a hole 78 at an end remote from the boss for connection with a manually operated release cable (not shown).

The boss 70 further includes a centrally splined portion 80 for engagement with a manually operable key barrel (not shown).

Operation of the latch assembly is as follows

With reference to figure 1 the latch assembly is shown in a closed position whereby the rotating claw is held in its latched position by the first pawl 44 which is in its corresponding first engaged position whereby tooth 48 engages the primary latching abutment 36. The release lever 50 is shown in its first engaged position and the second pawl 58 is shown in its first engaged position and the second pawl 58 is shown substantially in its first engaged position though as shown in figure 1 second pawl 58 is not engaging third arm 56 (see below).

The motor is energised for say 800 milliseconds, causing the rotor 24 to rotate anticlockwise in the direction of arrow A of the figure 2 resulting in post 30A engaging and moving first arm 52 to the position shown in figure 2. Clearly this movement of first arm 52 causing the release lever 50 and the first pawl 44 to both rotate about pivot 46 in a clockwise direction as shown by arrows B and C, thus disengaging pawl 48 from primary latching abutment 36.

During movement of release lever 50 from its first engaged position as shown in figure 1 to its second released position as shown in figure 2, the third arm 56 initially engages cam surface 64 causing second pawl 58 to rotate clockwise about pivot 60. Once the third arm 56 has passed the cam surface 64, the bias means (not shown) biases the second pawl 58 anticlockwise about pivot 60 such that the third arm 56 is engaged behind the hook 62, thus retaining the release lever 50 in the position as shown in figure 2. In this position the end of second arm 54 acts as a stop abutment in co-operation with post 30C preventing further rotation of rotor 24.

Typically the time taken to move from the position as shown in figure 1 to the position as shown figure 2 might be 500 milliseconds, thus the motor would be stalled for

the last 300 milliseconds of the 800 millisecond motor energisation as a result of post 30C abutting the end of second arm 54.

Once the latch assembly has achieved the position as shown in figure 2 the latch claw is free to rotate in a clockwise direction as shown by arrow E of figure 3 thus releasing the striker from the mouth 27 and allowing the door, or boot lid etc. to open.

Note that in figure 2 the latch bolt is shown in its primary latched position though is free to rotate to its open position, the first pawl is shown in its second released position, the release lever is shown in its second released position, and the second pawl is shown in its first engaged position whereby it engages third arm 56.

Further note that first pawl 44 is maintained in its second release position by co-operating abutments 44A and 50A, and the release lever is maintained in its second release position by the second pawl. Thus it is the second pawl that maintains the first pawl in its second release position via the intermediary of the release lever 50.

As described above during the movement of the rotating claw from the position as shown in figure 2 to the position as shown in figure 3, the pin 40 trips past the third pawl 66 without affecting the position of the second pawl 58 which continues to retain third arm 56 and hence the release lever 50 in its second released position.

It should be noted that during movement of the rotating claw from the position as shown in figure 2 to the position as shown in figure 3, the pawl tooth 48 of the first pawl 44 is held out of engagement with the rotating claw and thus cannot engage the secondary latching abutment 38 as it passes underneath the pawl tooth 48.

Subsequent closing of the door associated with the latch assembly 10 causes the striker pin (not shown) to enter mouth 27 and mouth 34 resulting in the rotating claw 32 rotating anticlockwise in a closing direction as shown by arrow F of figure 4 to a secondary latched position as shown by profile X of rotating claw 32 or, the door is slammed hard enough, to a primary latched position as shown by profile Y of the rotating claw 32. This

causes pin 40 to contact the third pawl 66 which, as described above, cannot rotate from the position shown in figure 4 clockwise relative to the second pawl 58. Thus the pin 40 causes the third pawl 66 and second pawl 58 to both rotate in unison clockwise as shown by arrow G about pivot 60. This action disengages the hook 66 from the end of third arm 56 allowing the release lever 50 and first pawl 44 to rotate anticlockwise as shown by arrows H and J thus re-engaging pawl tooth 48 with the primary or secondary latching abutment 36 or 38 as appropriate.

It should be noted that the relative positions of the pin 40, secondary latching abutment 38 and first pawl 44 is such that the hook 66 is caused to disengage the end of third arm 56 just before the secondary latching abutment 38 passes under pawl tooth 48. Thus in the event that the door is not slammed hard enough to be fully closed the pawl tooth 48 will nevertheless engage the secondary latching abutment 36 as described above.

Note that pin 40 moves past second pawl 58 when the rotating claw 32 moves from the closed position as shown in figure 1 to the open position as in figure 3 without affecting the position of the second pawl. Furthermore pin 40 again moves past second pawl 58 when moving from the open position as shown in figure 3 to the closed position as shown in figure 1, however, under these circumstances it does affect the position of the second pawl as it moves past the second pawl.

Subsequent energising of the motor 18 following closing of the latch as shown in figure 4 will unlatch the door in a similar sequence as described above, but note that post 30C (as opposed to post 30A as described above) is now positioned to act on first arm 52 to open the latch. In this case since there are three posts 30A, 30B and 30C, a single energising operation of motor 18 results in rotor 24 only rotating through 120 degrees.

In further embodiments there may be more or less than three posts connected to the rotor.

Manual operation of the manual release means 16 by either operation of the cable connected to hole 78 or operation of the key barrel engaged with splined portion 80 results

in post 74 rotating anticlockwise and engaging and moving first arm 52 in a manner similar to that as described above wherein post 30A engages and moves first arm 52. Note that during this manual disengagement the pawl tooth 48 cannot engage the secondary latching abutment 38 since it is held away from the rotating claw by the release lever 50 which is secured in its second released position by hook 62 as described above in relation to power opening of the latch.

With reference to figures 5 and 6 there is shown a second embodiment of a latch assembly 110 with features equivalent to latch assembly 10 labelled 100 greater.

A release arrangement 181 is formed by the combination of release lever 150 and pawl 144. In this case release lever 150 and pawl 144 are rotationally fast relative to each other, though in further embodiments this need not be the case.

Rotor 124 includes 3 abutments H1, H2 and H3 at a central portion of the rotor which form a first set of abutments H. Rotor 124 also includes abutments J1, J2 and J3 at a peripheral region of the rotor which form a second set of abutments J.

The release lever 150 and first set of abutments H lie in a first plane and the pawl 144 and second set of abutments J lie in a second plane different from the first plane thus allowing the second set of abutments J to pass underneath release lever 150 when the rotor 124 rotates.

Operation of the latch assembly 110 is as follows:-

Consideration of figure 6 shows the latch assembly 110 in a closed position with pawl 148 acting against latching abutment 136 to retain the rotating claw 132 in the closed position. It should be noted that abutment H1 is in contact with the end of release lever 150.

Actuation of motor 118 causes the rotor 124 to rotate in anticlockwise direction when viewing figure 6 whereupon abutment H1, acting on the end of release lever 150

causes the release lever and pawl 144 to rotate in a clockwise direction to the position as shown in figure 5.

It should be noted from figure 5 that abutment H1 has just disengaged the end of release lever 150 but at the same moment pawl tooth 148 has engaged abutment J2 thus stopping further rotation of the rotor and causing the motor 118 to momentarily stall until such time as the power to the motor is cut. Stopping the rotor 124 in this manner ensures that it is orientated in the correct position ready for its next operation.

Once the power to the motor is cut then there is no longer any force acting between abutment J2 and pawl tooth 148 whereupon the pawl 144 and release lever 150 can return to the position as shown in figure 6 (though with the rotor 124 and rotating claw 132 remaining in the position as shown in figure 5) awaiting a subsequent closure of the latch.

It should be noted that the release lever is sequentially operated by abutments H1, H2 and H3 and that the rotor 124 sequentially stopped by abutment J1, J2 and J3. Furthermore the release lever is only ever operated by abutments H1, H2 and H3 and the rotor is only ever stopped by abutments J1, J2 and J3.

Claims

1. A latch mechanism including;

a latch bolt moveable between a primary latched position and an open position,

a first pawl moveable between a first engaged position, where it secures the latch bolt in at least its primary latched position and a second released position, where it releases the latch bolt from at least its first primary latched position,

release means moveable between a first engaged position, where it allows the first pawl to achieve its first engaged position and a second released position, where it retains the first pawl in its second released position, and

a second pawl moveable between a first engaged position, where it is capable of retaining the release means in its second released position, and a second released position, where it releases the release means from its second released position,

such that the latch mechanism can be latched and unlatched.
2. A latch mechanism as defined in claim 1 in which the release means is fast with the first pawl.
3. A latch mechanism as defined in claim 1 in which release means is moveable relative to the first pawl.
4. A latch mechanism as defined in any preceding claim in which the latch bolt additionally has a secondary latched position intermediate the primary latch position and the open position.
5. A latch mechanism as defined in any preceding claim in which a trip abutment on the latch bolt is capable of moving the second pawl from its first engaged position to its second released position allowing the latch mechanism to latch.

6. A latch mechanism as defined in claim 5 in which the trip abutment is capable of moving the second pawl during movement of the latch bolt from its open position to its primary or secondary latched position.
7. A latch mechanism as defined in claim 5 or 6 in which the trip abutment does not affect retention of the release means in its second released position by the second pawl during movement of the latch bolt from its primary or secondary latched position to its open position.
8. A latch mechanism as defined in claim 5 or 6 or 7 in which the trip abutment moves the second pawl by engagement with a third pawl.
9. A latch mechanism as defined in claim 8 in which the third pawl allows the latched bolt to move from its primary or secondary latched position to its open position without movement of the second pawl.
10. A latch mechanism as defined in claim 8 or 9 in which the third pawl is mounted on the second pawl.
11. A latch mechanism as defined in claim 8 or 9 in which the third pawl is mounted on a chassis of the latch assembly.
12. A latch mechanism as defined in any preceding claim in which a first arm of the release means is engaged to move the release means from its first engaged position to its second released position.
13. A latch mechanism as defined in any preceding claim in which an arm (56) of the release means is engaged by the second pawl to retain the release means in its second released position.

14. A latch mechanism as defined in any preceding claim including a power actuator having a motor and a drive train.
15. A latch mechanism as defined in claim 14 in which the motor only operates in one direction.
16. A latch mechanism as defined in claim 14 or 15 in which the drive train only operates in one direction.
17. A latch mechanism as defined in any one of claims 14 to 16 in which the drive train includes a first abutment operable to move the release means from its first engaged position to its second released position.
18. A latch mechanism as defined in claim 17 when dependent upon claim 12 in which the first abutment of the drive train engages the first arm of the release means.
19. A latch mechanism as defined in claims 14 to 18 in which the drive train includes a second abutment which co-operates with the release means to provide a drive train stop.
20. A latch mechanism as defined in claim 19 in which the second abutment co-operates with an arm (54) of the release means.
21. A latch mechanism as defined in claim 19 or 20 when dependent upon claim 17 in which the first abutment is capable of acting as the second abutment.
22. A latch mechanism including a power actuator, the power actuator having a motor and a drive train, the drive train having at least one abutment for engagement with a release means of the latch mechanism, energisation of the motor causing the abutment to move the release means from a first engaged position to a second released position to release the latch, in which a retention means (58) is capable of retaining the release means in its second released position.

23. A latch mechanism including a power actuator, the power actuator having a motor and a drive train, the drive train having a plurality of abutments for engagement with a release arrangement of the latch mechanism, energisation of the motor causing one of the plurality of abutments to move the release arrangement from a first engaged position to second released position to release the latch, resulting in another of the plurality of abutments co-operating with the release arrangement to provide a drive train stop.

24. A latch mechanism as defined in Claim 23 in which the latch mechanism includes a latch bolt moveable between a primary latch position and an open position, and the release arrangement includes a first pawl moveable between a first engaged position where it secures the latch bolt in at least its primary latch position and a second release position, where it releases the latch bolt from at least its first primary latch position, the release arrangement further including release means moveable between the first engaged position, where it allows the first pawl to achieve its first engaged position and a second release position where it retains the first pawl in its second release position.

25. A latch mechanism as defined in Claim 24 in which the release means is fast with the first pawl.

26. A latch arrangement as defined in Claim 24 in which the release means is moveable relative to the first pawl.

27. A latch mechanism as defined in Claims 23 to 26 in which the plurality of abutments includes a first set of abutments to move the release arrangement from the first engaged position to the second release position and a second set of abutments for co-operation with the release arrangement to provide the drive train stop.

28. A latch mechanism as defined in Claim 27 when dependent upon Claim 24 in which the first set of abutments acts on the release means and the second set of abutments act on the pawl.

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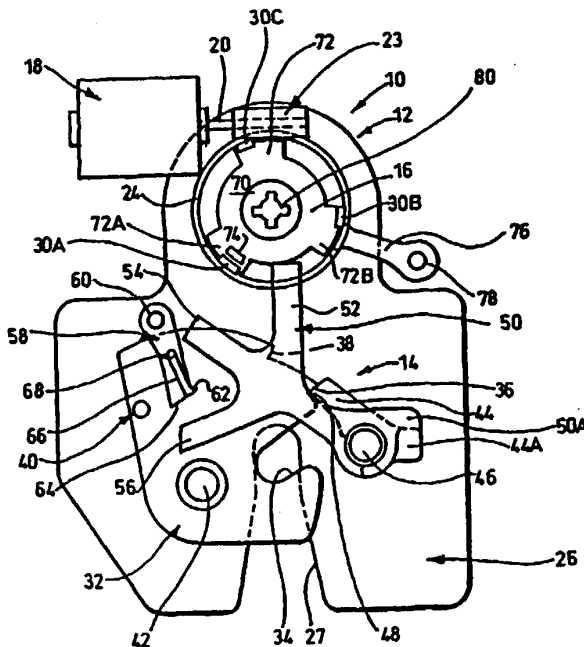
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(54) Title: LATCH ASSEMBLY

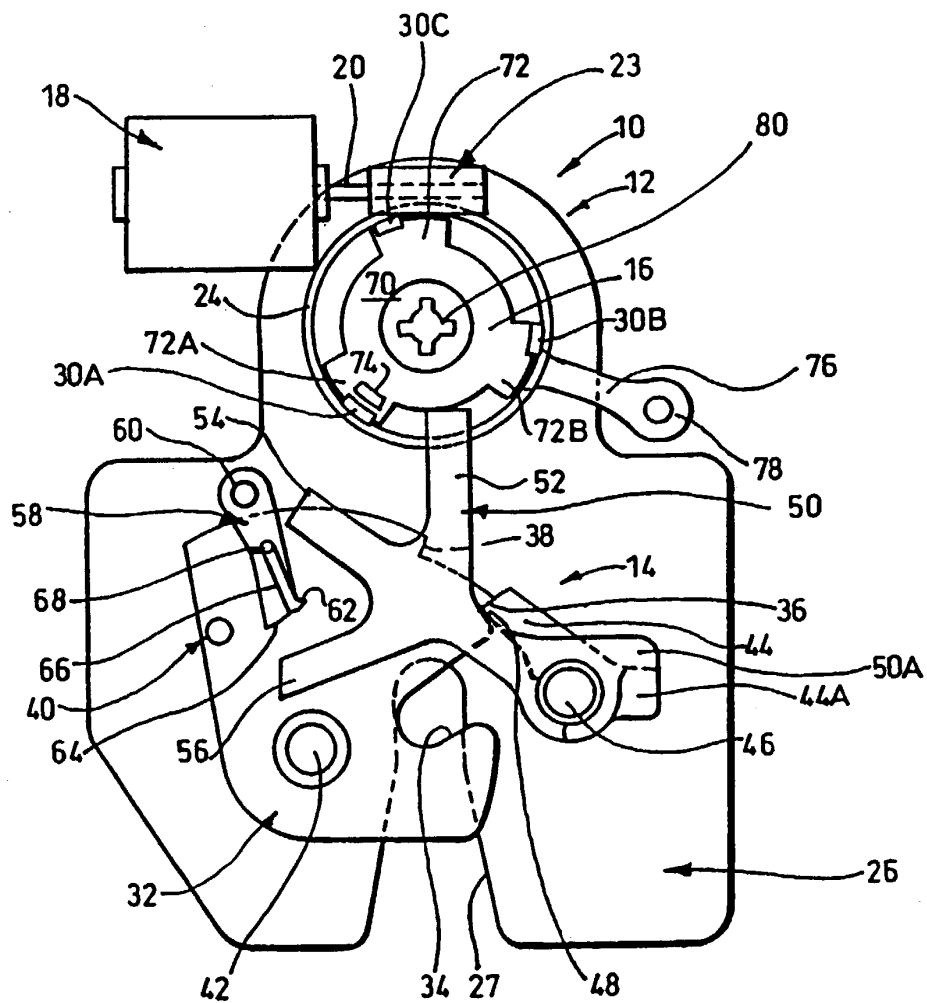


LATCH CLOSED

(57) Abstract: A latch mechanism (10) including: a latch bolt (32) moveable between a primary latched position and an open position, a first pawl (44) moveable between a first engaged position, where it secures the latch bolt in at least its primary latched position and a second released position, where it releases the latch bolt from at least its first primary latched position, release means (50) moveable between a first engaged position, where it allows the first pawl to achieve its first engaged position and a second released position, where it retains the first pawl in its second released position, and a second pawl (58) moveable between a first engaged position, where it is capable of retaining the release means in its second released position, and a second released position, where it releases the release means from its second released position, such that the latch mechanism can be latched and unlatched.

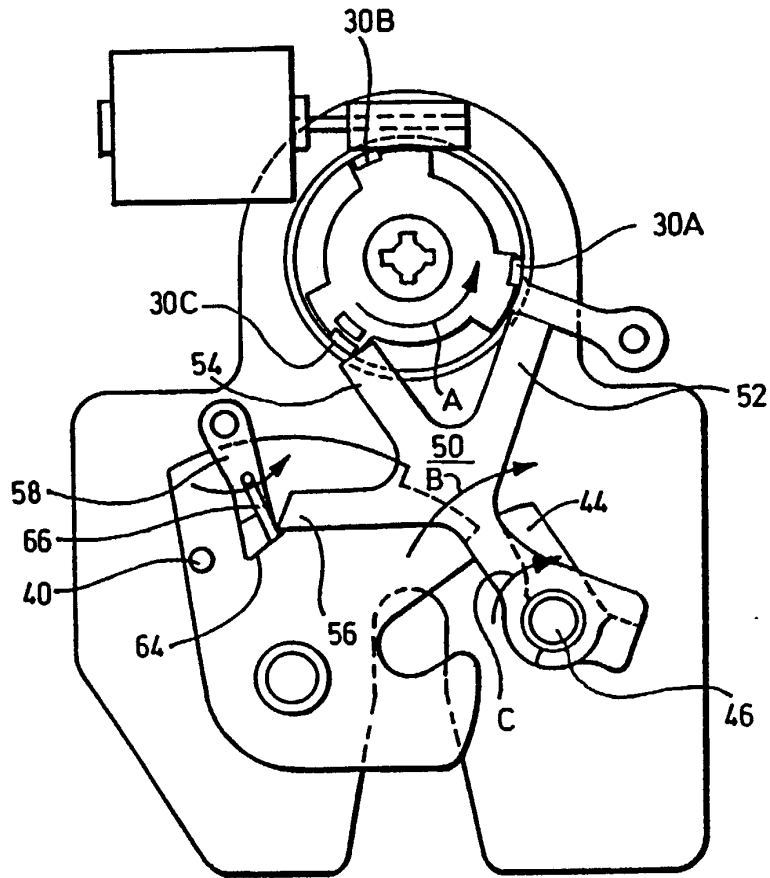
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LATCH CLOSED

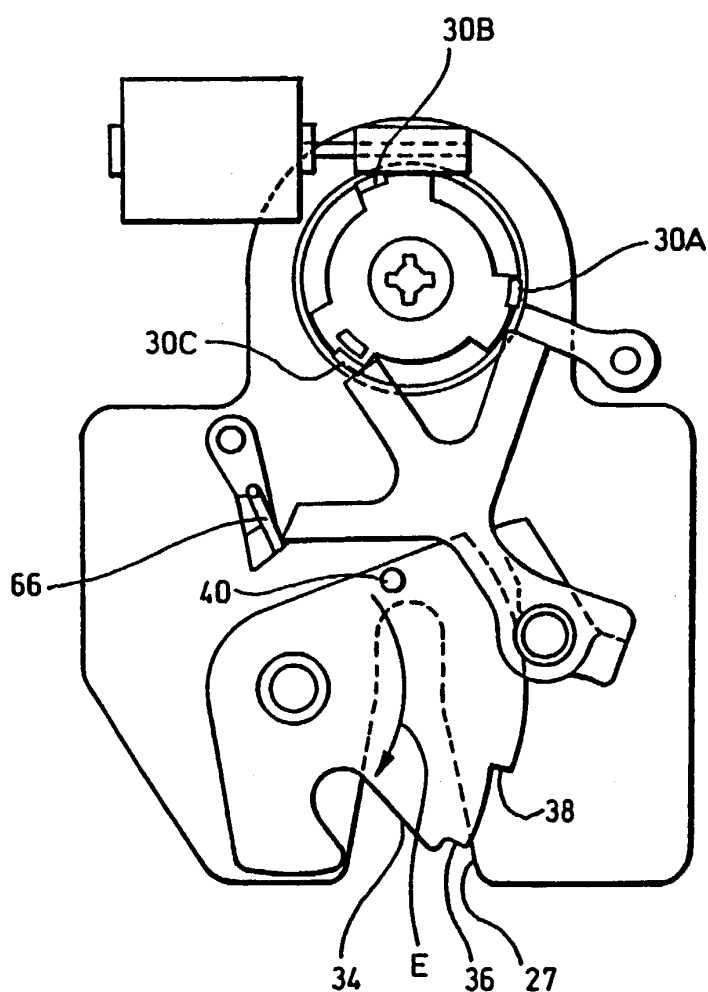
FIG.1.



UNLATCHING

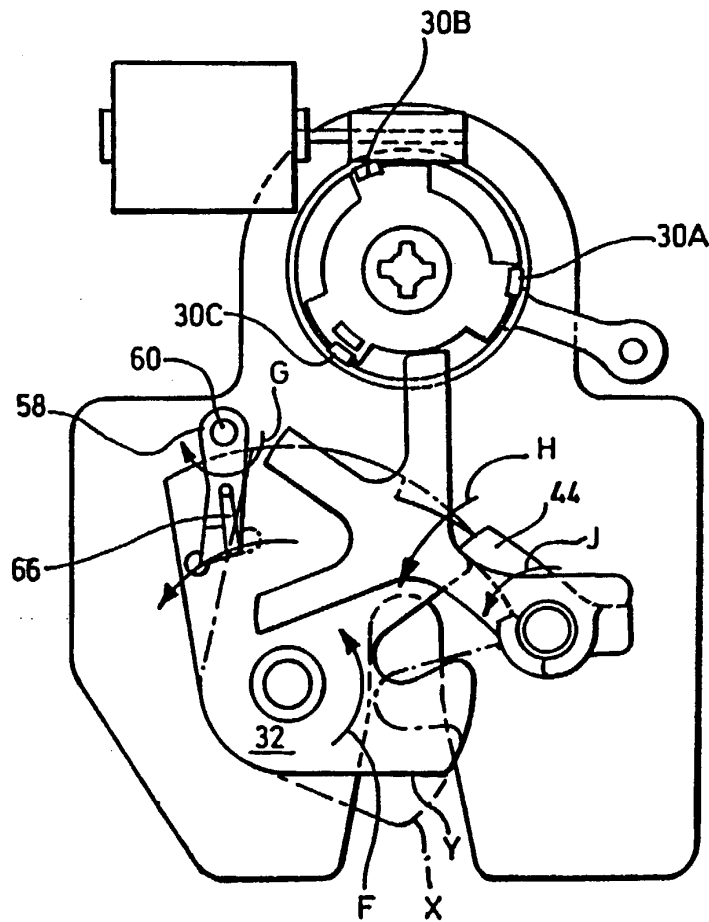
FIG.2.

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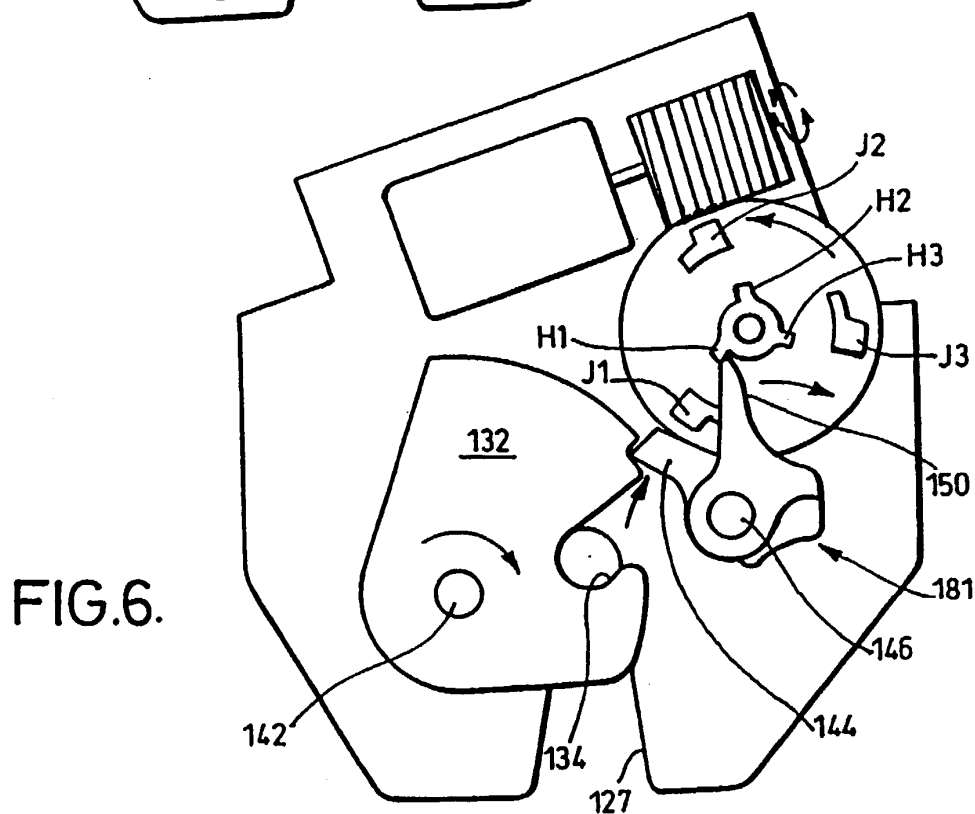
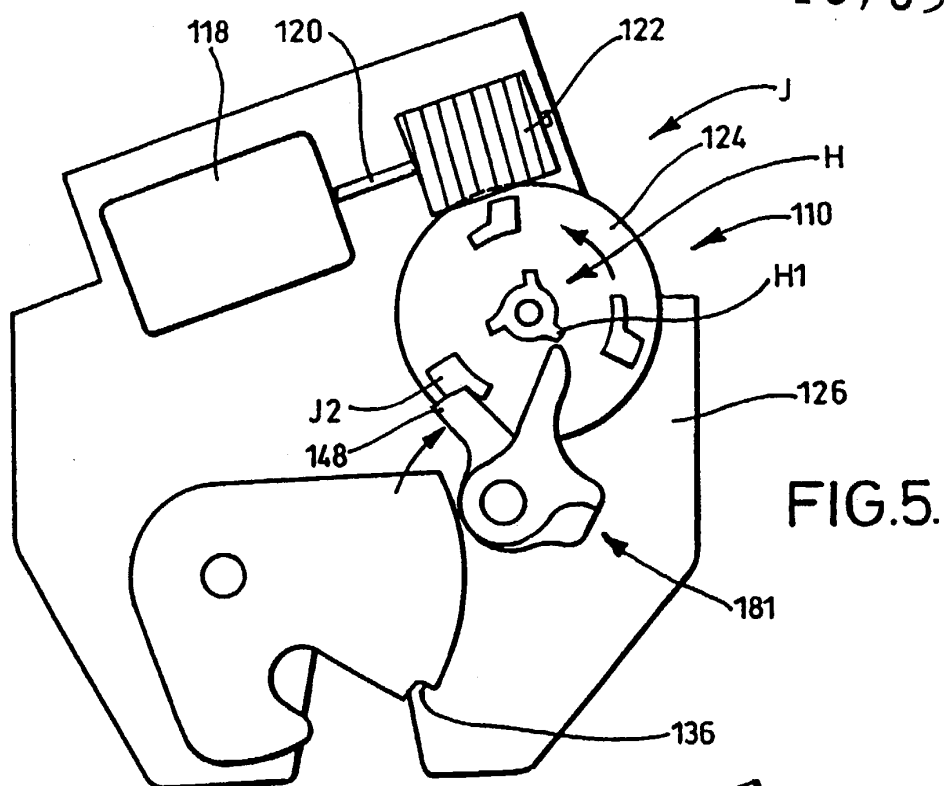
LATCH OPENING

FIG.3.



LATCHING

FIG. 4.



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LATCH ASSEMBLY

The present invention relates to latch assemblies, and in particular latch assemblies which are manually operable alone or latch assemblies which are both manually operable and power actuator operable.

The present invention is particularly applicable to latches used on vehicle doors such as car passenger doors or car boot doors.

Vehicle door latches are known which are released using a power actuator. Typically the door latch would have a latch bolt retained in position by a pawl and the actuator would act on a release lever connected to the pawl or would act directly on the pawl to release the latch. After the actuator's power stroke, the actuator must return to its initial state in one of three traditional methods:-

- a) Reverse energising of the motor such that the motor is spun in its opposite direction e.g., reversing the polarity on an electric motor,
- b) Declutching a clutch mechanism situated between the motor and a drive train of the actuating mechanism and returning the drive train by a weak spring,
- c) Back driving the whole of the actuator mechanism including motor and drive train a strong spring.

The problem with reversing the polarity is that many modern vehicle controllers do not allow reverse polarity and more noise is generated due to longer motor operating duration.

The problem with an actuator incorporating a clutch mechanism is that the clutch mechanism itself is expensive, complex and has several parts and that such clutches do not operate consistently.

The problem with back driving the motor and power train is that the motor must be more powerful (and thus more expensive and heavier) to overcome the strong spring, more noise is generated due to longer operating duration, and some systems using helical gears cannot be back driven due to the large lead angle of the helical gears.

Known latch assemblies have primary latched positions wherein the associated door is fully closed and secondary latched positions wherein the associated door is not fully shut but nevertheless is prevented from opening. Such an arrangement has been used particularly on passenger doors of cars as a safety feature and in a legal requirement in many countries. Typically the door seals situated around the periphery of the door, which provide a weather tight seal between the door and its associated aperture, are resilient and are compressed when the door is in its closed condition. Releasing of the latch then allows the seals to partially open the door, at least past the secondary latched position, allowing the user to then fully open the door.

However a problem with such an arrangement is that under some conditions the seal force which tends to open the door can be insufficient to push the latch bolt past the secondary latched position resulting in a door that only opens to the secondary latched position. Under such circumstances the latch has to be unlatched again from the secondary latched position either manually by pulling on a door handle again or in the case of an actuator driven latch by operating the actuator for a second time and pulling the door open. Insufficient seal load could be caused by a door frozen into a closed position, poor fit/misalignment of the door, heavy vertically opening rear boot lids.

It is an object of the present invention to provide a latch assembly including a power actuator which does not require to be driven in a reverse direction.

It is another object of the present invention to provide a latch assembly including a power actuator which does not require clutch mechanisms between a motor and a drive train of the power actuator.

It is another object of the present invention to provide a latch assembly including a power actuator which does not require back driving of the drive train and motor.

It is another object of the present invention to provide a latch assembly having a latch mechanism that does not engage a secondary latch position when operated.

Thus according to the present invention there is provided a latching mechanism including a latch bolt moveable between a primary latched position and an open position,

a first pawl moveable between a first engaged position where it secures the latch bolt in at least its primary latched position and a second released position where it releases the latch bolt from at least its first primary latched position,

release means moveable between a first engaged position where it allows the first pawl to achieve its first engaged position and a second released position where it retains the first pawl in its second released position, and

a second pawl moveable between a first engaged position where it is capable of retaining the release means in its second released position and a second released position where it releases the release means from its second released position.

such that the latch mechanism can be latched and unlatched.

According to a further aspect of the present invention there is provided latch mechanism including a power actuator, the power actuator having a motor and a drive train, the drive train having at least one abutment for engagement with a release means of the latch mechanism, energisation of the motor causing the abutment to move the release means from a first engaged position to a second released position to release the latch, in which a retention means (58) is capable of retaining the release means in its second released position.

According to a further aspect of the present invention there is provided a latch mechanism including a power actuator, the power actuator having a motor and a drive train, the drive train having the plurality of abutments for engagement with a release arrangement of the latch mechanism, energisation of the motor causing one of the plurality

of abutments to move the release arrangement from a first engaged position to second released position to release the latch, resulting in another of the plurality of abutments co-operating with the release arrangement to provide a drive train stop.

The invention will now be described, by way of example only, with reference to the drawings in which:-

Figure 1 is a view of a latch assembly according to the present invention in a closed condition;

Figure 2 is a view of the latch assembly of figure 1 shown in an unlatching condition;

Figure 3 is a view of the latch assembly of figure 1 shown in a latch opening condition;

Figure 4 is a view of the latch assembly of figure 1 shown in a latching condition whereby super-imposed views of the rotating claw are shown in a primary latched position and secondary latched position; and

Figures 5 and 6 are views of a second embodiment of a latch assembly according to the present invention in an open and closed condition.

With reference to figure 1 to 4 there is shown a latch assembly 10 including a power actuator 12, a latch mechanism 14 and a manual release means 16.

In use the latch assembly 10 would be mounted on a door.

The power actuator includes a motor 18 having a motor shaft 20 drivingly connected to a pinion 22. The power actuator further includes a drive train in the form of a rotor 24.

Rotor 24 is journaled for rotation on plate 26 which forms part of the chassis of the latch assembly. Rotor 24 includes a set of gear teeth 28 which together with pinion 22 form a worm/worm gear drive arrangement. The rotor further includes three circumferentially equispaced posts 30A, 30B, 30C, which project out of the plane of the paper of figure 1.

The latched mechanism includes a latch bolt in the form of a rotating claw 32 having a mouth 34, a primary latching abutment 36, a secondary latching abutment 38 and a trip abutment in the form of a pin 40. The claw 32 is pivotally mounted about pivot 42 on plate 26.

Plate 26 includes a mouth 27 which in conjunction with the mouth 34 provides for the retention and release of a striker pin (not shown) mounted on an associated door aperture.

The rotating claw 32 is biased in a clockwise direction as shown in figure 1 by a resilient means (not shown), though in further embodiments this need not be the case.

The latch mechanism further includes a first pawl 44 pivotally mounted for rotation about pivot 46. Pawl 44 includes a pawl tooth 48 for engagement with the primary and secondary latching abutments 36 and 38 of the rotating claw. Also mounted rotationally about pivot 46 is a release lever 50 having first, second and third arms 52,54,56 respectively. Release lever 50 is biased in an anticlockwise direction by a resilient means (not shown) operably acting between the release lever 50 and the plate 26.

A further resilient means (not shown) operates between the first pawl 44 and release lever 50 to bias the first pawl 44 in an anticlockwise direction relative to the release lever 50. Abutment 44A on the first pawl and abutment 50A release on the lever co-operates to limit the anticlockwise movement of the first pawl relative to the release lever.

The latch mechanism further includes a second pawl 58 rotatably mounted about pivot 60 which is turn is mounted on plate 26. Second pawl 58 includes a hook 62 remote from pivot 60 and also a cam surface 64. Second pawl 58 is biased in an anticlockwise

direction by a resilient means (not shown) operating between the second pawl 58 and the plate 26. An abutment (not shown) prevents the second pawl 58 from rotating further anticlockwise than is shown in figure 1.

Mounted on second pawl 58 is a third pawl 66 pivotally mounted about pivot 68. Third pawl 66 is arranged such that it can pivot anticlockwise about pivot 68 as a result of contact with pin 40 when the rotating claw 32 moves from a position shown in figure 1 to a position shown in figure 3 i.e. in an opening direction but cannot rotate about pivot 68 clockwise from the position shown in figures 1 and 4 when the rotating claw 32 (and hence the pin 40) moves from the position as shown in figure 4 to the position as shown in figure 1 i.e. in a closing, there being an abutment (not shown) to prevent any such clockwise rotation.

In further embodiments the third pawl could be mounted on the chassis of the latch assembly and nevertheless co-operate with the second pawl 58 and pin 40 to release the latch mechanism as described below.

The manual release means 16 comprises a boss 70 having three equispaced lobes 72A, 72B and 72C which bear on an inner surface of the rotor 24 to allow rotation of the boss 70 relative to the plate 26. Lobe 72A includes a post 74 projecting out of the plane of the paper of figure 1 substantially parallel to post 30A.

Lobe 72B further includes an arm 76 having a hole 78 at an end remote from the boss for connection with a manually operated release cable (not shown).

The boss 70 further includes a centrally splined portion 80 for engagement with a manually operable key barrel (not shown).

Operation of the latch assembly is as follows

With reference to figure 1 the latch assembly is shown in a closed position whereby the rotating claw is held in its latched position by the first pawl 44 which is in its corresponding first engaged position whereby tooth 48 engages the primary latching

abutment 36. The release lever 50 is shown in its first engaged position and the second pawl 58 is shown in its first engaged position and the second pawl 58 is shown substantially in its first engaged position though as shown in figure 1 second pawl 58 is not engaging third arm 56 (see below).

The motor is energised for say 800 milliseconds, causing the rotor 24 to rotate anticlockwise in the direction of arrow A of the figure 2 resulting in post 30A engaging and moving first arm 52 to the position shown in figure 2. Clearly this movement of first arm 52 causing the release lever 50 and the first pawl 44 to both rotate about pivot 46 in a clockwise direction as shown by arrows B and C, thus disengaging pawl 48 from primary latching abutment 36.

During movement of release lever 50 from its first engaged position as shown in figure 1 to its second released position as shown in figure 2, the third arm 56 initially engages cam surface 64 causing second pawl 58 to rotate clockwise about pivot 60. Once the third arm 56 has passed the cam surface 64, the bias means (not shown) biases the second pawl 58 anticlockwise about pivot 60 such that the third arm 56 is engaged behind the hook 62, thus retaining the release lever 50 in the position as shown in figure 2. In this position the end of second arm 54 acts as a stop abutment in co-operation with post 30C preventing further rotation of rotor 24.

Typically the time taken to move from the position as shown in figure 1 to the position as shown figure 2 might be 500 milliseconds, thus the motor would be stalled for the last 300 milliseconds of the 800 millisecond motor energisation as a result of post 30C abutting the end of second arm 54.

Once the latch assembly has achieved the position as shown in figure 2 the latch claw is free to rotate in a clockwise direction as shown by arrow E of figure 3 thus releasing the striker from the mouth 27 and allowing the door, or boot lid etc. to open.

Note that in figure 2 the latch bolt is shown in its primary latched position though is free to rotate to its open position, the first pawl is shown in its second released position, the

release lever is shown in its second released position, and the second pawl is shown in its first engaged position whereby it engages third arm 56.

Further note that first pawl 44 is maintained in its second release position by co-operating abutments 44A and 50A, and the release lever is maintained in its second release position by the second pawl. Thus it is the second pawl that maintains the first pawl in its second release position via the intermediary of the release lever 50.

As described above during the movement of the rotating claw from the position as shown in figure 2 to the position as shown in figure 3, the pin 40 trips past the third pawl 66 without affecting the position of the second pawl 58 which continues to retain third arm 56 and hence the release lever 50 in its second released position.

It should be noted that during movement of the rotating claw from the position as shown in figure 2 to the position as shown in figure 3, the pawl tooth 48 of the first pawl 44 is held out of engagement with the rotating claw and thus cannot engage the secondary latching abutment 38 as it passes underneath the pawl tooth 48.

Subsequent closing of the door associated with the latch assembly 10 causes the striker pin (not shown) to enter mouth 27 and mouth 34 resulting in the rotating claw 32 rotating anticlockwise in a closing direction as shown by arrow F of figure 4 to a secondary latched position as shown by profile X of rotating claw 32 or, the door is slammed hard enough, to a primary latched position as shown by profile Y of the rotating claw 32. This causes pin 40 to contact the third pawl 66 which, as described above, cannot rotate from the position shown in figure 4 clockwise relative to the second pawl 58. Thus the pin 40 causes the third pawl 66 and second pawl 58 to both rotate in unison clockwise as shown by arrow G about pivot 60. This action disengages the hook 66 from the end of third arm 56 allowing the release lever 50 and first pawl 44 to rotate anticlockwise as shown by arrows H and J thus re-engaging pawl tooth 48 with the primary or secondary latching abutment 36 or 38 as appropriate.

It should be noted that the relative positions of the pin 40, secondary latching abutment 38 and first pawl 44 is such that the hook 66 is caused to disengage the end of

A release arrangement 181 is formed by the combination of release lever 150 and pawl 144. In this case release lever 150 and pawl 144 are rotationally fast relative to each other, though in further embodiments this need not be the case.

Rotor 124 includes 3 abutments H1, H2 and H3 at a central portion of the rotor which form a first set of abutments H. Rotor 124 also includes abutments J1, J2 and J3 at a peripheral region of the rotor which form a second set of abutments J.

The release lever 150 and first set of abutments H lie in a first plane and the pawl 144 and second set of abutments J lie in a second plane different from the first plane thus allowing the second set of abutments J to pass underneath release lever 150 when the rotor 124 rotates.

Operation of the latch assembly 110 is as follows:-

Consideration of figure 6 shows the latch assembly 110 in a closed position with pawl 148 acting against latching abutment 136 to retain the rotating claw 132 in the closed position. It should be noted that abutment H1 is in contact with the end of release lever 150.

Actuation of motor 118 causes the rotor 124 to rotate in anticlockwise direction when viewing figure 6 whereupon abutment H1, acting on the end of release lever 150 causes the release lever and pawl 144 to rotate in a clockwise direction to the position as shown in figure 5.

It should be noted from figure 5 that abutment H1 has just disengaged the end of release lever 150 but at the same moment pawl tooth 148 has engaged abutment J2 thus stopping further rotation of the rotor and causing the motor 118 to momentarily stall until such time as the power to the motor is cut. Stopping the rotor 124 in this manner ensures that it is orientated in the correct position ready for its next operation.

Once the power to the motor is cut then there is no longer any force acting between abutment J2 and pawl tooth 148 whereupon the pawl 144 and release lever 150 can return

to the position as shown in figure 6 (though with the rotor 124 and rotating claw 132 remaining in the position as shown in figure 5) awaiting a subsequent closure of the latch.

It should be noted that the release lever is sequentially operated by abutments H1, H2 and H3 and that the rotor 124 sequentially stopped by abutment J1, J2 and J3. Furthermore the release lever is only ever operated by abutments H1, H2 and H3 and the rotor is only ever stopped by abutments J1, J2 and J3.

Claims

1. A latch mechanism including;

a latch bolt moveable between a primary latched position and an open position,

a first pawl moveable between a first engaged position, where it secures the latch bolt in at least its primary latched position and a second released position, where it releases the latch bolt from at least its first primary latched position,

release means moveable between a first engaged position, where it allows the first pawl to achieve its first engaged position and a second released position, where it retains the first pawl in its second released position, and

a second pawl moveable between a first engaged position, where it is capable of retaining the release means in its second released position, and a second released position, where it releases the release means from its second released position,

such that the latch mechanism can be latched and unlatched.
2. A latch mechanism as defined in claim 1 in which the release means is fast with the first pawl.
3. A latch mechanism as defined in claim 1 in which release means is moveable relative to the first pawl.
4. A latch mechanism as defined in any preceding claim in which the latch bolt additionally has a secondary latched position intermediate the primary latch position and the open position.
5. A latch mechanism as defined in any preceding claim in which a trip abutment on the latch bolt is capable of moving the second pawl from its first engaged position to its second released position allowing the latch mechanism to latch.

6. A latch mechanism as defined in claim 5 in which the trip abutment is capable of moving the second pawl during movement of the latch bolt from its open position to its primary or secondary latched position.
7. A latch mechanism as defined in claim 5 or 6 in which the trip abutment does not affect retention of the release means in its second released position by the second pawl during movement of the latch bolt from its primary or secondary latched position to its open position.
8. A latch mechanism as defined in claim 5 or 6 or 7 in which the trip abutment moves the second pawl by engagement with a third pawl.
9. A latch mechanism as defined in claim 8 in which the third pawl allows the latched bolt to move from its primary or secondary latched position to its open position without movement of the second pawl.
10. A latch mechanism as defined in claim 8 or 9 in which the third pawl is mounted on the second pawl.
11. A latch mechanism as defined in claim 8 or 9 in which the third pawl is mounted on a chassis of the latch assembly.
12. A latch mechanism as defined in any preceding claim in which a first arm of the release means is engaged to move the release means from its first engaged position to its second released position.
13. A latch mechanism as defined in any preceding claim in which an arm (56) of the release means is engaged by the second pawl to retain the release means in its second released position.
14. A latch mechanism as defined in any preceding claim including a power actuator having a motor and a drive train.

22. A latch mechanism including a power actuator, the power actuator having a motor and a drive train, the drive train having at least one abutment for engagement with a release means of the latch mechanism, energisation of the motor causing the abutment to move the release means from a first engaged position to a second released position to release the latch, in which a retention means (58) is capable of retaining the release means in its second released position.

23. A latch mechanism including a power actuator, the power actuator having a motor and a drive train, the drive train having a plurality of abutments for engagement with a release arrangement of the latch mechanism, energisation of the motor causing one of the plurality of abutments to move the release arrangement from a first engaged position to second released position to release the latch, resulting in another of the plurality of abutments co-operating with the release arrangement to provide a drive train stop.

24. A latch mechanism as defined in Claim 23 in which the latch mechanism includes a latch bolt moveable between a primary latch position and an open position, and the release arrangement includes a first pawl moveable between a first engaged position where it secures the latch bolt in at least its primary latch position and a second release position, where it releases the latch bolt from at least its first primary latch position, the release arrangement further including release means moveable between the first engaged position, where it allows the first pawl to achieve its first engaged position and a second release position where it retains the first pawl in its second release position.

25. A latch mechanism as defined in Claim 24 in which the release means is fast with the first pawl.

26. A latch arrangement as defined in Claim 24 in which the release means is moveable relative to the first pawl.

27. A latch mechanism as defined in Claims 23 to 26 in which the plurality of abutments includes a first set of abutments to move the release arrangement from the first engaged position to the second release position and a second set of abutments for co-operation with the release arrangement to provide the drive train stop.

28. A latch mechanism as defined in Claim 27 when dependent upon Claim 24 in which the first set of abutments acts on the release means and the second set of abutments act on the pawl.

Abstract

A latch mechanism (10) including;

a latch bolt (32) moveable between a primary latched position and an open position,

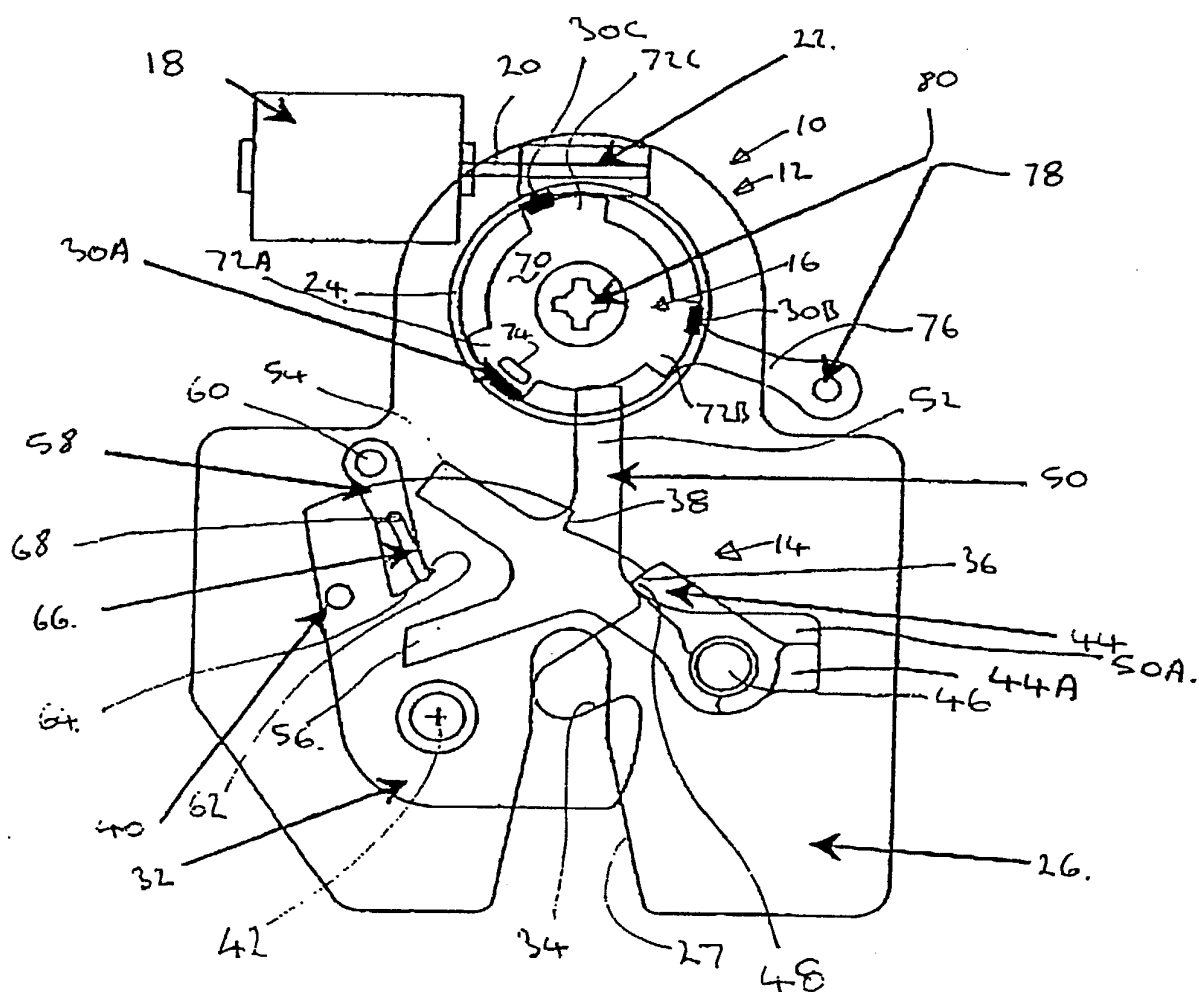
a first pawl (44) moveable between a first engaged position, where it secures the latch bolt in at least its primary latched position and a second released position, where it releases the latch bolt from at least its first primary latched position,

release means (50) moveable between a first engaged position, where it allows the first pawl to achieve its first engaged position and a second released position, where it retains the first pawl in its second released position, and

a second pawl (58) moveable between a first engaged position, where it is capable of retaining the release means in its second released position, and a second released position, where it releases the release means from its second released position,

such that the latch mechanism can be latched and unlatched (figure 1).

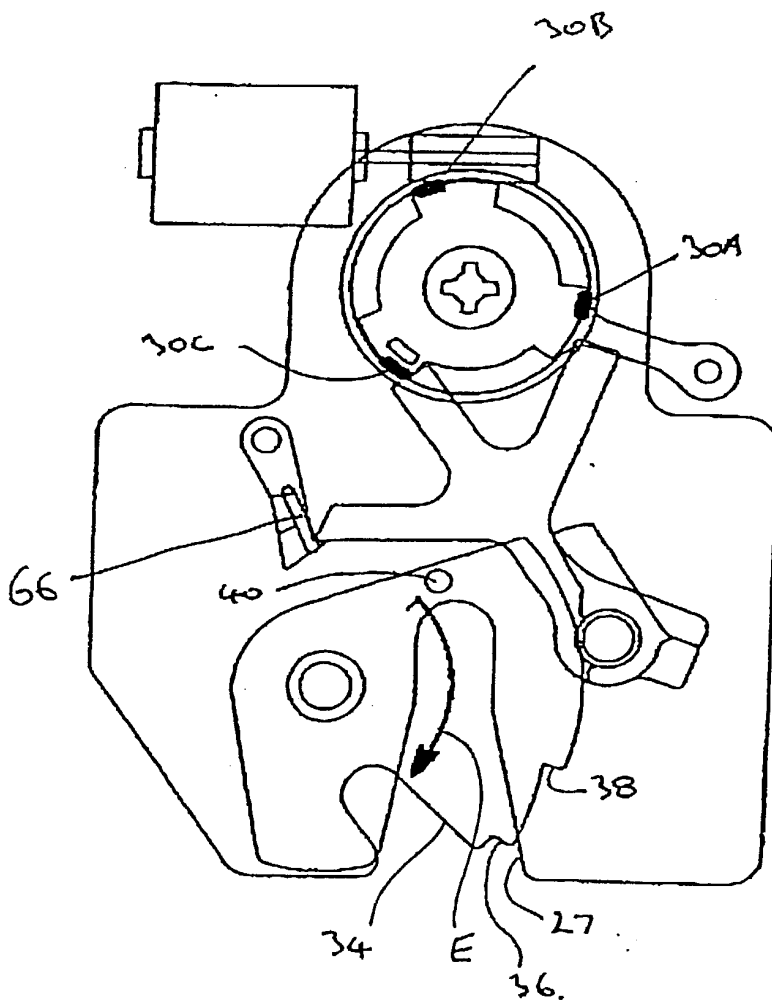
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LATCH CLOSED

FIG-1

3/5



LATCH OPENING.

FIG 3

4/ .5

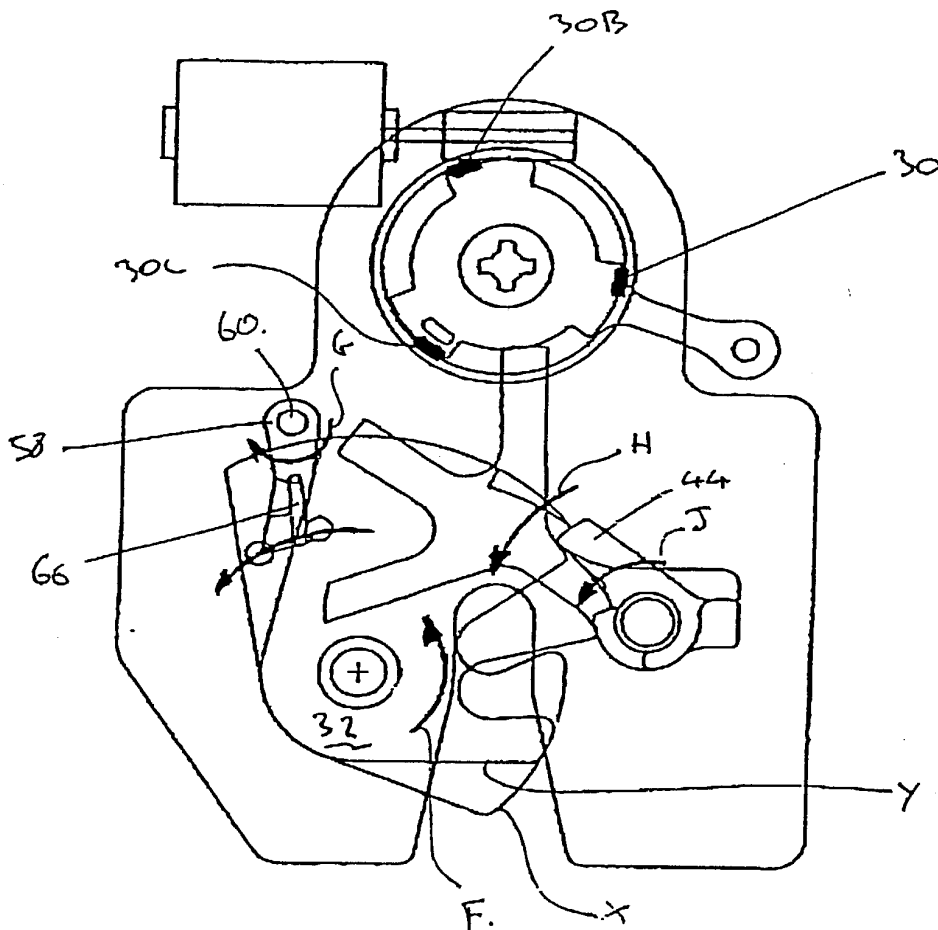


FIG 4

LATCHING.

[illegible]